

CLAIMS

- 1 1. A method of measuring a power spectrum of an optical
2 signal, comprising:
3 transmitting the optical signal through an optical fiber;
4 coupling a power of at least one wavelength of the optical signal
5 from a first mode to a second mode of the waveguide; and
6 measuring the power of the optical signal coupled from the first
7 mode to the second mode at a detector.
- 1 2. The method of claim 1, wherein a mode coupler is provided
2 to couple the power of the at least one wavelength.
- 1 3. The method of claim 2, wherein the mode coupler is selected
2 from an acoustic grating, a UV grating, a bending grating and a stress
3 induced grating.
- 1 4. The method of claim 2, wherein the mode coupler includes
2 an acoustic wave generator and an acoustic wave propagation member
3 coupled to the optical fiber.
- 1 5. The method of claim 1, further comprising:
2 removing that portion of the at least one wavelength that is not
3 coupled from the first mode to the second mode
- 1 6. The method of claim 4, wherein the wavelength of the optical
2 signal coupled from the first mode to the second mode is changed by
3 varying a frequency of an acoustic wave produced by a mode coupler
4 coupled to the optical fiber.
- 1 7. The method of claim 1, wherein the mode coupler produces
2 multiple acoustic signals with individual controllable strengths and

3 frequencies and each of the signals provides a coupling between one mode
4 to a different mode.

1 8. The method of claim 1, wherein an amount of the optical
2 signal coupled from the first mode to the second mode is changed by
3 varying an amplitude of a signal applied to the mode coupler.

1 9. The method of claim 1, wherein at least one core mode is
2 converted to a different core mode.

1 10. The method of claim 1, wherein at least one core mode is
2 converted to a cladding mode.

1 11. The method of claim 1, wherein at least one cladding mode is
2 converted to a core mode.

1 12. The method of claim 1, wherein at least one cladding mode is
2 converted to a different cladding mode.

1 13. The method of claim 1, wherein the wavelength coupled
2 from the first mode to the second mode is changed by varying a frequency
3 of an acoustic wave produced by the mode coupler.

1 14. The method of claim 1, wherein a mode converter is
2 provided to produce multiple acoustic signals with individual controllable
3 strengths and frequencies and each of an acoustic signals provides a
4 coupling between one mode to a different mode.

1 15. The method of claim 1, wherein a mode coupler is coupled to
2 the optical fiber and configured to provide at least one perturbation in the
3 optical fiber to create a coherent coupling between a first mode to a second
4 mode in the optical fiber.

1 16. The method of claim 1, further comprising:
2 changing the polarization of the optical signal prior to coupling the
3 light.

1 17. The method of claim 1, wherein the first and second modes
2 have different polarization states in the optical fiber.

1 18. The method of claim 1, further comprising:
2 detecting a power spectrum of a band of wavelengths that have been
3 coupled.

1 19. The method of claim 1, further comprising:
2 detecting a power spectrum of coupled second mode wavelengths.

1 20. The method of claim 1, further comprising:
2 adjusting a strength of a signal that provides coupling between the
3 first and second modes.

1 21. The method of claim 1, further comprising:
2 scanning through a range of signals that provide coupling between
3 the first and second modes.

1 22. The method of claim 1, further comprising:
2 adjusting a strength of a signal that provides coupling between the
3 first and second mode to maximize coupling between the first and second
4 modes.

1 23. The method of claim 1, further comprising:
2 dithering a strength of a signal that provides coupling between the
3 first and second mode to maximize coupling between the first and second
4 modes.

1 24. A method of monitoring a power spectrum of an optical
2 signal, comprising:
3 changing polarizations of the optical signal in a polarization
4 scrambler;
5 coupling a first mode of the optical signal to a second mode at a
6 mode converter;
7 detecting the second mode at a detector;
8 generating a signal responsive to detection of the second mode;
9 averaging the signal to measure a power of the second mode,
10 wherein measurement of the power of the second mode is
11 polarization independent.

1 25. The method of claim 24, wherein a wavelength of the optical
2 signal coupled from the first mode to the second mode is changed by
3 varying a frequency of an acoustic signal applied to the mode coupler.

1 26. The method of claim 24, wherein the mode coupler produces
2 multiple acoustic signals with individual controllable strengths and
3 frequencies and each of the acoustic signals provides a coupling between
4 one mode to a different mode.

1 27. The method of claim 24, wherein an amount of the optical
2 signal coupled from the first mode to the second mode is changed by
3 varying an amplitude of an acoustic signal applied to the mode coupler.

1 28. The method of claim 24, wherein at least one core mode is
2 coupled to a different core mode.

1 29. The method of claim 24, wherein at least one core mode is
2 coupled to a cladding mode.

1 30. The method of claim 24, wherein at least one cladding mode
2 is coupled to a core mode.

1 31. The method of claim 24, wherein at least one cladding mode
2 is coupled to a different cladding mode.

1 32. The method of claim 24, wherein a wavelength coupled from
2 the first mode to the second mode is changed by varying the frequency of an
3 acoustic signal applied to the mode coupler.

1 33. The method of claim 24, wherein the mode converter
2 produces multiple acoustic signals with individual controllable strengths and
3 frequencies and each of the acoustic signals provides a coupling between
4 one mode to a different mode.

1 34. The method of claim 24, wherein the mode converter
2 provides at least one perturbation in the optical fiber to create a coherent
3 coupling between the first mode to the second mode in the optical fiber.

1 35. A spectral monitor, comprising:
2 an optical fiber with multiple modes;
3 a mode coupler coupled to the optical fiber, the mode coupler
4 provides at least one perturbation in the optical fiber to create a coherent
5 coupling between the first mode to the second mode in the optical fiber;
6 a detector positioned to detect a coupling power spectrum of the
7 coupling from the first mode to the second mode; and
8 a feedback control coupled to the mode coupler and the detector to
9 control the power of the coupling power.

1 36. The apparatus of claim 35, wherein the mode coupler is
2 selected from an acoustic grating, a UV grating, a bending grating and a
3 stress induced grating.

1 37. The apparatus of claim 35, wherein the mode coupler
2 includes an acoustic wave generator and an acoustic wave propagation
3 member coupled to the optical fiber.

1 38. The monitor of claim 35, further comprising:
2 a polarization scrambler coupled to the optical fiber and the mode
3 coupler.

1 39. The monitor of claim 35, further comprising:
2 a modal filter coupled to the mode coupler and the detector.

1 40. A spectral monitor, comprising:
2 an optical fiber with multiple modes;
3 a mode coupler coupled to the optical fiber and configured to
4 provide at least one perturbation in the optical fiber to create a coherent
5 coupling between a first mode to a second mode in the optical fiber; and
6 a core-blocking member coupled to the optical fiber, the core
7 blocking member configured to substantially block those portions of the first
8 mode that are not coupled to the second mode.

1 41. The monitor of claim 40, wherein the core blocking member
2 includes a reflective material positioned over a core region of a distal end
3 of the optical fiber.

1 42. The monitor of claim 40, wherein the mode coupler is
2 selected from an acoustic grating, a UV grating, a bending grating and a
3 stress induced grating.

1 43. The monitor of claim 40, wherein the mode coupler includes
2 an acoustic wave generator and an acoustic wave propagation member
3 coupled to the optical fiber.

1 44. The monitor of claim 40, further comprising:
2 a polarization scrambler coupled to the optical fiber and the mode
3 coupler.

1 45. A polarization independent spectral monitor, comprising:
2 an optical fiber with multiple modes;
3 a first mode coupler coupled to the optical fiber, the first mode
4 coupler producing a first acoustic wave in the optical fiber to couple a first
5 mode of an optical signal to a second mode in the optical fiber; and
6 a second mode coupler coupled to the optical fiber, the second mode
7 coupler producing a second acoustic wave in the optical fiber that is
8 orthogonal to the first acoustic wave.

1 46. The monitor of claim 41, wherein each mode coupler
2 includes an acoustic wave generator and an acoustic wave propagation
3 member coupled to the optical fiber.

1 47. The monitor of claim 41, further comprising:
2 a modal filter coupled to the second mode coupler and the optical
3 fiber; and
4 a detector coupled to the modal filter.

1 48. A polarization independent spectral monitor, comprising:
2 an optical fiber with multiple modes; and
3 a mode coupler coupled to the optical fiber and configured to
4 produce independent orthogonal acoustic waves in the optical fiber that
5 couple a first mode to a second mode; and

6 a detector positioned to detect a coupling power spectrum of the
7 coupling from the first mode to the second mode.

1 49. The spectral monitor of claim 48, wherein the mode coupler
2 includes, a first pair and a second pair of electrodes, the first and second
3 pairs producing the horizontal and vertical independent acoustic waves in
4 response to application of first and second voltages to each pair of
5 electrodes.

1 50. The monitor of claim 48, further comprising:
2 a modal filter coupled to the mode coupler and the optical fiber; and
3 a detector coupled to the modal filter.